Light and Lighting

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Contents

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Airport Lighting

WE live in what is sometimes called the atomic age, but it might with equal pertinence be termed the radio age, or the aerial transport age, for radio communication and air travel are developments in our time which are of enormous significance. Among the hazards which aerial travel involves is that of accident in landing, and accidents are the more difficult to avoid the poorer the visibility of the landing ground. The lighting of airports to facilitate landing at night and at other times when visibility is low, is therefore a most important matter, and it is gratifying that the best method of airport lighting yet developed is of British origin, and is used at London Airport, which many pilots consider the best-lighted airport in the world. In the current issue of the I.E.S. *Transactions* this method of lighting is described in detail and reported upon by experienced pilots. When other major airports are completely closed on account of bad visibility, safe landing is possible at London Airport, so it is to be hoped that the successful British method will speedily be adopted at important aerodromes in other parts of this country as well as overseas.

Notes and News

The Lighting of Churches

The Central Council for the Care of Churches has recently issued an interesting leaflet on the lighting of churches by electricity. The leaflet will, we are sure, be useful in a number of respects to those responsible for church lighting, but there are one or two points on which we are prepared to quarrel with the authors.

For instance, the leaflet appears to have been written by architects or others who have either not heard of or refuse to acknowledge the existence of those who have specialised in lighting — the rather too humble lighting engineers. In the second paragraph of this leaflet appears the sentence, "Where a new lighting scheme is under consideration, it is therefore essential that guidance of an architect familiar with church requirements, or a qualified electrical engineer, should be obtained." Now the architect and the electrical engineer are both very useful people and they both dabble a little in lighting. Some, though few, are well qualified to advise on lighting. On the other hand, some lighting engineers, in fact quite a number, are qualified electrical engineers; but we doubt if anyone would recommend seeking their advice on, say, power station design. We hope to persuade the church authorities that their first step when considering the lighting of a church is to consult a lighting engineer, not a few of whom have specialised in this subject and between them have been responsible for the lighting of most of the well-lit churches.

Not the least of the functions of the lighting engineer would be to advise on the type of fitting to be used. We see that the leaflet recommends that fittings should be "specially designed by an architect." Failing this it is suggested that fittings from the general section of a manufacturer's catalogue may be preferable to those offered as being specially intended for churches, "many of which embody pseudo-Gothic architectural ornament unsuitable for the purpose." We refrain from comment on this section, but we are only more convinced that, assuming the body responsible for this document have ever consulted a lighting engineer, they have disregarded anything he told them.

We recall that only last year a paper on the lighting of churches was presented to the I.E.S. in London by Mr. L. C. Rettig. On this occasion the church authorities, ecclesiastical architects, etc., were invited to be present, and though a few representatives were present the attendance from these people was poor. The same thing happened in the provinces, where a number of skilled lighting engineers have lectured on this subject and where the church authorities were specially invited to be present and to take part in the discussions. The lectures were, however, attended by quite a few clergymen, who were sufficiently interested in the subject, so perhaps there are some who will not accept without question the advice given them by this central body.

A.P.L.E. Annual Conference

As announced in our last issue the Association of Public Lighting Engineers will this year be holding its annual meeting and conference at Bournemouth from Monday, September 18, to Friday, September 22. It is understood that already a number of delegates have been appointed by local authorities and that notification has been received that a number of overseas visitors intend to be

present. In addition there will be many representatives from the Gas and Electricity Boards and there is therefore every indication of a large attendance.

The Conference Sessions at which interesting papers are to be presented will be held in the Winter Gardens. In addition there will be an exhibition of modern street lighting apparatus at the Town Hall in which many of the leading manufacturers will be participating. There will also be an outdoor display of lamp columns, traffic signs and tower waggons, etc.

Further details of the programme are now available, the main items being as follows :—

Monday, September 18.

- 3.15 p.m. Annual General Meeting.
- 3.45 p.m. Official opening of conference and induction of the new President, Mr. P. Richbell.
- 8.0 p.m. Civic Reception at the Pavilion.

Tuesday, September 19.

- 10.30 a.m. Presidential Address by Mr. P. Richbell.
- 2.30 p.m. Address by Dr. J. W. T. Walsh on "The Draft Code of Practice for Street Lighting."

Wednesday, September 20.

- 10.0 a.m. Paper by Mr. T. Beecroft on "Proposal for a Code of Practice and the Modernisation of Existing Gas Installations on Group 'B' Roads."
- 2.30 p.m. Paper by Mr. E. B. Sawyer on "Lighting as a Public Amenity."

Thursday, September 21.

- 10.0 a.m. Paper by Mr. A. J. Harris on "Some Problems of Road Safety Research connected with the Lighting of Streets."
- 12.30 p.m. Annual Luncheon.
- 8.0 p.m. Reception by the President at the Pavilion.

Friday, September 22.

- 10.0 a.m. Paper by Dr. W. E. Harper, Mr. P. H. Collins and Mr. H. P. Walker on "The Design and Performance of Acrylic Street Lighting Equipment."

The programme also includes arrangements for the entertainment of ladies.

Association Française des Eclairagistes

The Association Français des Eclairagistes, the French I.E.S., has recently issued the first number of a new periodical bulletin to its members. From this we gathered a number of items of information regarding our French colleagues, not the least of which was the news of the re-election of M. Gaymard as President of the Association for a further year.

The A.F.E., though not large in numbers, is a most enthusiastic body. Its membership is largely centred on Paris, where most of its activities take place. We learn, however, that it has recently decided to form its first provincial centre at Lyons; no doubt, centres in other provincial towns will follow in due course.

One of the subjects which they appear to be studying rather more closely than we in this country is that of cinema auditorium lighting. Some years before the war an I.E.S. committee carried out some work on this subject but little attention seems to have been given to their recommendations and as far as we know no original work on the lighting of cinemas is now being done. Our French colleagues on the other hand recently organised a meeting of lighting engineers and cinema technicians at which several papers were presented and where the discussion was so live that part of the arranged programme had to be deferred for another time. We are particularly interested in their discussion on screen surround lighting and look forward to getting full details in due course.

View of the Delro shop in Oxford Street. The louvre ceiling contains natural colour fluorescent lamps and is extended through the glass outer partition into the interior thereby attracting prospective clients into the shop.

A completely modernised lighting system has been installed throughout the 27,000-ton Canadian Pacific liner Empress of Scotland, during the refitting completed recently at Govan by her builders, the Fairfield Shipbuilding and Engineering Co., Ltd. The liner has been refitted after an arduous and distinguished war record, and returned to passenger sailings on the North Atlantic route between Canada and Great Britain on May 9.

The whole of the lighting installation, which includes the use of Osram cold cathode fluorescent tubing in the public rooms, has been designed and supplied by The General Electric Co., Ltd. The work also included the modernisation of some of the original fittings which have been retained. The cold cathode tubing is used in glazed and indirect cornices and in decorative fittings of special design. Over 5,000 ft. of cold cathode tubing are used, forming what is believed to be the largest installation of its kind in any ship in the world.

As a refit, the Empress of Scotland has had some spaces restored and decorated as before, and the adaptability of cold cathode tubing is shown by its having been successfully installed in such spaces. In other spaces, where extensive reconversion has taken place, more scope has been allowed for the decorative features of the lighting. Except in feature fittings, such as in the cocktail bar, where exposed coloured tubes are used, the fluorescent lighting is unobtrusive, and the aim has been to secure high lighting efficiency and even illumination; and to reduce heat dissipation, which otherwise would have to be dealt with by ventilation or air conditioning systems.

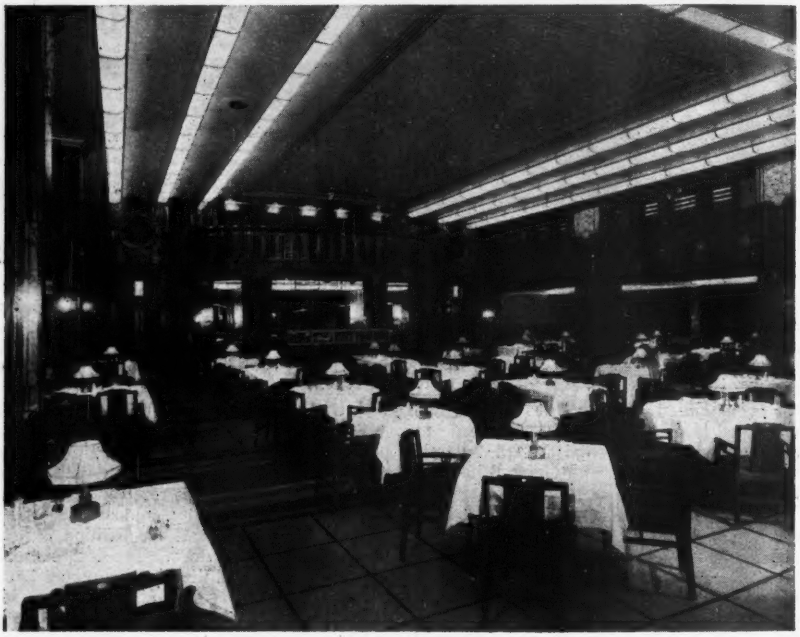
In planning the lighting the principle has been followed of avoiding colour contrast between the cold cathode and tungsten illumination, so that no marked impression of a change in colour is received when passing from an area lit by cold cathode tubes alone to one where all the lighting is provided by tungsten lamps. The cold cathode lighting for general illumination comes from a combination of gold and ivory tubes, installed behind white flashed opal glazing. After much experiment a satisfactory method was found of harmonising the tungsten lighting with the resultant colour of the cold cathode lighting combination. In all parts of the ship the metalwork of the glazed cornices containing cold cathode tubing is in matt silver bronze.

In the main dining room on "C" deck the cold cathode tubing is contained in three tiers of continuous glazed cornices running round three sides of the ceiling well above the main area. Similar cornice sections, broken up into individual panels, are installed on the lower ceiling in the wings of the saloon, and are arranged as a continuous run in the annexe. A total of approximately 1,500 ft. of tubing is employed here. The

lighting in this room also includes numerous smaller tungsten lighting units and 80 table lamps, the latter having pigskin shades with old gold trimming. Window lighting at the sides of the room is by concealed filament lamps in 108 special recessed fittings with silvered glass reflectors.

The "C" deck foyer adjacent to the main dining room is lighted by 190 ft. of cold cathode tubing in glazed cornices and a series of handsome decorative glazed ceiling ceiling fittings. A flush panel unit lights the display shelves behind the bar.

Cold cathode lighting in cornices is used extensively on other parts of the promenade deck. There are 260 ft. of tubing in glazed cornices in the long gallery running between the cocktail bar and the lounge, and 450 ft. in similar fittings to light the main entrance on that deck. In both spaces there is additional lighting from tungsten lamps. The card and writing rooms have indirect cold



The main dining room.

fittings, supplemented by various small tungsten lamp fittings.

Three decorative ceiling features consisting of visible cold cathode tubing formed into leaf-shaped motifs provide a special lighting effect in the cocktail bar on the promenade deck. All the lighting in this area, apart from six emergency lamps, is cold cathode. The remainder of the general lighting in the bar is indirect from tubes concealed in cornices. The three window bays, which form small alcoves furnished with chairs and tables, are lighted by cold cathode tubing in shallow box type glazed cathode cornice lighting, supplemented by tungsten lamps in Georgian style wall brackets finished in French gilt.

Two recessed ceiling panel fittings containing cold cathode tubes provide the general lighting in the promenade deck children's room, while special tungsten fittings are installed to light the dolls' house and the cots. The tourists' children's room at the aft end of the deck is lighted by cold cathode tubing in indirect cornices. Various

Right:(Above) The cocktail bar and *(Below)* the long gallery.

The first-class lounge.

supplementary tungsten fittings in this room include a special blackboard lighting unit.

In all the entrance halls cold cathode tubes are accommodated in glazed cornices and behind laylights to illuminate the tops of the staircases. The cold cathode lighting in the tourist dining saloon, on "D" deck, is entirely indirect, there being three rectangular cornice panels, each with a central indirect lighting feature to ensure uniformity of illumination over the whole ceiling area.

The only exceptions to the use of ivory and gold tubing in the cold cathode installations are seen in the shops in the main entrance and the tourists' lounge, where intermediate colour tubes are recessed behind the showcases.

The swimming pool in "D" deck is lighted by cold cathode fluorescent tubes in a glazed cornice on the deck head, following the outline of the bath, and forming a rectangle measuring about 32 ft. by 13 ft.; further tubing is installed in a central ceiling fitting, 18 ft. long. Tungsten lamps are employed on the bulkheads, in cubicles, and for under-water lighting.

The principal rooms lighted exclusively with tungsten lamps are the first class lounge, first class smokeroom ("Empress" Room) and the tourist class public rooms (apart from the dining saloon). In the first class lounge the fittings are in French gilt, and in the "Empress" Room they are in Penny bronze. Various bronze finishes are used in the tourist class rooms except for the nursery, where the fittings are cellulosed pink.

The total number of cold cathode and tungsten fittings in the rooms described is approximately 600, and over 1,200 Osram filament lamps of various wattages are used.

Two 75-kVA motor-alternators, made at the G.E.C. Witton Engineering works, are installed in the engine room to convert the ship's 220-volt d.c. supply to 230-volt, 50 cycles, a.c. for the cold cathode lighting. One machine is in service at a time, the other being available as a stand-by. The motors and alternators are direct-coupled, and each set is equipped with a belt-driven exciter. The G.E.C. has also supplied the starters and output voltage regulators, the latter being designed to maintain the lighting supply within very close limits during variations of the mains input.

Reconstruction at the Birmingham Art Gallery

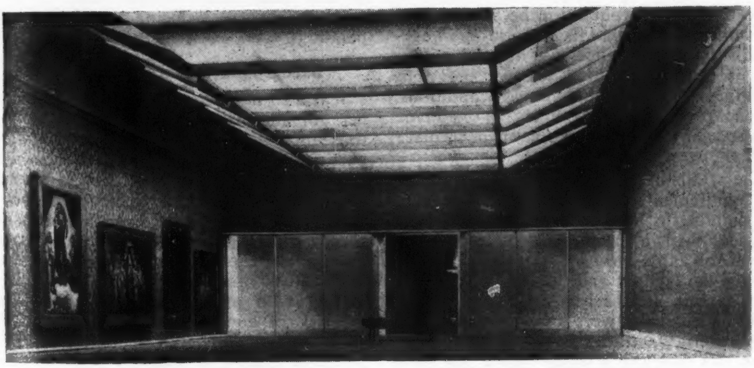
The Building Research Station has been asked to advise on the reconstruction of damaged rooms in the Birmingham City Art Gallery. This article describes how they are treating the problem, which is one of both technical and architectural interest.

Extremely good conditions for vision are required if colour and contrast on the paintings are to be properly seen, while the nature of the exhibits demands a good architectural setting. The two are intimately linked because the requirements for good vision influence both the shape of the room and many of the architectural details.

Major Design Principles

Treatment is derived mainly from two major principles, one that the paintings should hang in the strongest light, and the other that the brightness of other surfaces in view should not be greater, and should preferably be a little less, than that of the paintings. The first of these requirements is met in the design for the Birmingham Art Gallery by ensuring that from the paintings themselves a full view of the sky is available through the skylight while, from all other points above and below, the views of sky are more restricted. Thus, above the pictures the walls turn inward like a cornice to obstruct the view of the sky, and below them the light is restricted by the suspended laylight. Such a requirement plays a major part in determining the cross-section through the design.

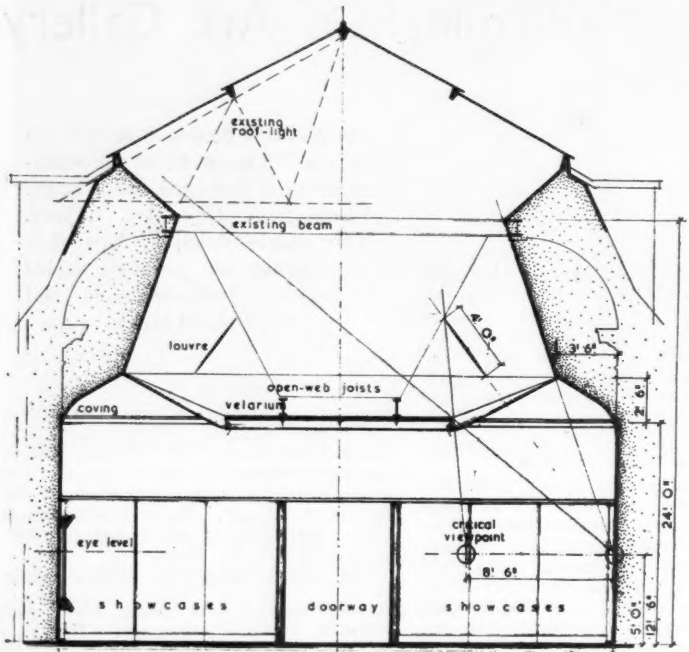
The second requirement is more subtle.



General view of the model room. glass velarium and end showcases. The main artificial lighting for the paintings comes from special fluorescent fittings along the outer edge of the velarium.

It is most important that it should not be possible to see the sky when looking at the paintings, because under this condition the eyes will partly adapt to outdoor brightness and full sensitivity to colour and contrast will not be possible. The function of the laylight is to prevent people from seeing the sky while allowing a reasonable amount of light to come through to the floor. The recommended laylight is a form of "egg-crate" louvring, which has the advantage that it can be coloured to give the right brightness for optimum visual conditions. In one room a trial is likely to be made of a special cloth-on-glass treatment in place of the "egg-crate" louvring.

The width of the laylight is restricted by the requirements for full view of sky from the paintings. Strictly, the laylight should be wider than in the present design in order to cut off any view of sky between the edge of the laylight and the edge of the skylight as one approaches the paintings. It could be wider if it were lower, but the room proportions would be affected. To overcome this difficulty a single louvre has been introduced above the gap on each side of the laylight in such a way that it offers no obstruction to light for the pictures, but screens the undesired view of sky. In this way the bright views of sky have been controlled and, by a suitable choice of material for the laylight, the levels of illumination in the main body of the room may be adjusted without reducing the light on the paintings.



Showing a cross section of the proposed design.

Background Surfaces and Colours

It is also necessary to consider the brightness of the paintings in comparison with those of other surfaces within the gallery, particularly the picture walls. Studies of a large number of paintings showed that the great majority have a reflection value of about 15-25 per cent. and this indicates that the best background for paintings would have a value of about 20 per cent. Such low values would not be possible in a gallery with an exposed skylight without the risk of contrast, which would make it seem rather dark and gloomy, but it is perfectly feasible in a gallery with controlled

View looking up to roof light. The velarium itself has been removed to show support beams of the louvres.

lighting. This in turn led to a study of the desirable colours and other characteristics of surfaces for the background of paintings, from which it was decided that probably the most successful for general use would be one of red. Attention has been given to the exact colours to be used, the nature of the pattern to be provided, and so on.

Having determined the surface treatment for the main wall, it was then possible to consider the treatment of other wall surfaces to produce similar brightnesses with the varied amounts of light falling upon them. For example, the widely differing amounts of light falling on the inside of the cornice and the upper surface which forms the reveal of the skylight can be made to give equal brightnesses, as seen from within the gallery, by choosing surface finishes with suitable reflection factors.

Reflection in Glass

The problem of reflections in glass on paintings runs like a thread through the whole of gallery design. Glass seems to be used chiefly to keep the paintings clean, but it does this only with moderate success. No way is known by which irritating reflections can be entirely avoided, and the real solution seems to be to leave the glass off. This means that the air in the building has to be clean. Air-conditioning would ensure this, but is expensive. An alternative may be to draw in filtered air and rely on a slight positive pressure inside the building to avoid the infusion of dirty air. This is being considered.

The artificial lighting forms part of the design. From the experience obtained by the Ministry of Works on the National Gallery it is known which position will give the best intensities and distribution of light without excessive wattage, and it is fortunately convenient in the present design to fit fluorescent light sources into the edge of the laylight, which is the right point. Other sources, mainly tungsten, will be fixed in the space above the laylight to supplement the fluorescent lighting, and in this way the various surfaces in the room will be lit in very much the same way as they are in daytime. A mixture of tungsten and fluorescent is proposed in order to give a good colour to the light.

In the present state of architecture it is impossible to deduce ideas in this detail without the aid of model studies, particularly as they concern exact amounts of light reaching different surfaces. A model to a scale of 1 inch to the foot was prepared in this case and was used in the course of the investigation. The ideas are applicable in principle to other conventional top-lit galleries.

Previous Experience

In attempting a new treatment of an old problem it is always desirable to look

doubly carefully at what has gone before. Established traditions and common experience often have a great deal to teach if they can be fully understood.

Art galleries are exceptional. No single tradition has been established, though the search for it has been vigorous. Attempts have been made to use each of several general arrangements, and all have been criticised. It seems to be a fact that the problem was too complex to solve merely by experience, though F. P. Cockerell might have set foot on the right course if recommendations made by him for the National Gallery in 1850 had been carried out. It is interesting that the recommendations by the Station, coming a century later and from a laboratory rather than from practice, bear a strong resemblance to Cockerell's ideas.

It should not be assumed, of course, that the solution which is applied in this case to an existing gallery would be the way to design a new one; current trends in display techniques and other reasons would indicate a variety of solutions.

The general reconstruction work is in the hands of the City of Birmingham Public Works Department, under Mr. H. T. Manzoni, C.B.E., City Engineer and Surveyor

Colour Sensitivity of the Eye

The meeting of the Colour Group, held on June 14 at the Institute of Ophthalmology, provided a great opportunity for the physiologists. Dr. L. C. Thomson, of the Vision Research Unit at the Institute, and a co-worker with Dr. W. D. Wright at the Imperial College of Science, read a paper entitled "Foveal Colour Sensitivity." To be more strictly accurate, he gave an informal and very lucid account of work he had been doing on the sensitivity curve of the central fovea, and in so doing he "put the cat among the pigeons"—if these supposedly peaceful fowl can, without irreverence, be taken to represent such eminent specialists in the colour vision field as Prof. Hartridge, Dr. Willmer, Dr. Dartnall, and the chairman of the Group, Dr. Stiles.

Dr. Thomson first showed a diagram indicating his determinations of the sensitivity of the eye throughout the spectrum, using a very small test stimulus, so that only a minute portion of the central fovea (therefore completely free from rods) was illuminated. It was clear that the curve was not a smooth one, like the familiar luminosity curve, but that it had a number of minor but nevertheless unmistakable humps and depressions. Further, the positions and, to a first approximation, the extent of these humps were the same in earlier work reported by Crawford.

In order to obtain the true sensitivity curve of the retinal receptors, Dr. Thomson applied corrections for (a) the transmission of the lens and other ocular media, and (b) the layer traversed by the light immediately before it reached the cones. He then considered the interpretation of the results in terms of the various hypotheses put forward with regard to the mechanism of colour vision at the fovea. On the evidence available he found it necessary to postulate more than two mechanisms, but his results did not confirm the system proposed by Prof. Hartridge.

Called on by the chairman to open the discussion, Prof. Hartridge said that he did not believe in the existence of the yellow macular pigmentation whose absorption Dr. Thomson had allowed for in his derivation of the final sensitivity curve; he had never been able to detect the existence of such a pigment histologically, and at a later point in the discussion he suggested a test by which it might be possible to demonstrate whether it were present or not. He referred to the appearance of two absorption bands which were visible near the end of a spectrum formed by a system of low dispersion. These disappeared if a high dispersion system were used or if the spectrum were reduced in breadth, so that presumably they were only visible when the amount of light available was large.

After a reference by Dr. Willmer to some work on deuteranopes, indicating that the sensitivity curve of one foveal receptor had its maximum at a wave-length of 0.58 μ Dr. Stiles described experiments which he had been carrying out on the sensitivity curve of the blue-mediating mechanism. The sensitivity curves at the centre of the fovea and 10 deg. away from it showed a difference which could be explained by a macular pigmentation with an absorption curve very similar to that of lutein, a substance which had been suggested as the chief compotent of the pigment.

Other speakers then joined in the discussion, which principally centred round the presence or absence of a macular pigment and its probable nature, as evidenced by its light absorption curve. No conclusion was reached and, as in fact Dr. Thomson was at pains to point out in his paper, much more work is necessary before the matter can be settled. Nevertheless, it does appear that considerable progress has already been made towards a fuller understanding of how we perceive the colours of objects.

Light as a Standard of Length

One of the duties of the national standardising laboratories is the maintenance of the standard of measurement. This article briefly explains how the wave-length of light can be used as the basis of a specification for a standard of length.

Length is one of the fundamental quantities in terms of which all physical measurements of any kind whatsoever can be expressed. The others are mass, time, an electromagnetic quantity, and a temperature interval. The photometric units are not purely physical, so that a factor is required to connect the physical quantity, the watt, with the lumen.

The maintenance of the fundamental units to the highest possible degree of accuracy is naturally a matter of vital importance, both to science and to industry. All the national standardising laboratories have, therefore, as one of their principal duties, the maintenance of the national units of these quantities in agreement with those of other countries and with the international standards kept at the Bureau International des Poids et Mesures at Sèvres, near Paris.

The unit of length is at present maintained by means of a bar of platinum-iridium of the special cross-section shown in Fig. 1. The surface A has two fine lines engraved on it, and the distance between the centres of these lines is the fundamental unit of length, the metre. Copies of this international standard are kept at all the national standardising laboratories in the different countries, and these copies are compared from time to time with the fundamental standard at Sèvres.

The great disadvantage of this form of standard is that it cannot be reproduced from a specification, so that if the fundamental standard and all the copies were destroyed, they could not be replaced with any high degree of accuracy. In this respect the unit of time is much superior, for it is defined by the rate of rotation of the earth and so can be described as a "natural" unit. For a long time the desirability of having a natural standard of length has been realised, and in fact the original definition of the metre was of this kind, viz., one ten-millionth of the distance on the earth's surface from the pole to the equator. Unfortunately, the accurate determination of this distance is attended by very great practical difficulties, and so metrologists have looked elsewhere for a natural unit of length and have found it in what might well be regarded as an unexpected quarter.

The wave theory of light pictures it as travelling through space in a manner which may, in certain respects, be compared with the passage of ripples over the surface of water, the wave-length of the light corresponding to the distance between successive crests of the water waves. Most of the light we meet with in our ordinary experience consists of a mixture of a vast number of components, each with its own particular wavelength; but when an electric discharge passes through a gas or vapour, such as mercury or sodium, the mixture is a much simpler one and consists of a limited number of components which can be separated from one another by suitable means, e.g., by passage through a glass prism, so that light of one wavelength only can be isolated. Such

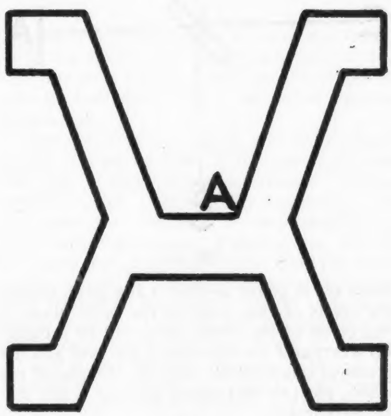


Fig. 1.

"monochromatic" light forms a natural standard of length for, under specified conditions, the wave-length is quite invariable and independent of the form of the apparatus used to produce the light.

In passing, it is interesting to note that as long ago as 2700 B.C. the Chinese used as a standard of length a stick of bamboo which had two knots at such a distance apart that, when the stick was used as a whistle, it emitted a given note, so that it was, in effect, a standard based on the wave-length of sound.

The use of the wave-length of monochromatic light as a standard of length depends on the phenomenon known as "interference," which, as its name implies, is the effect of superposing two sets of waves. If

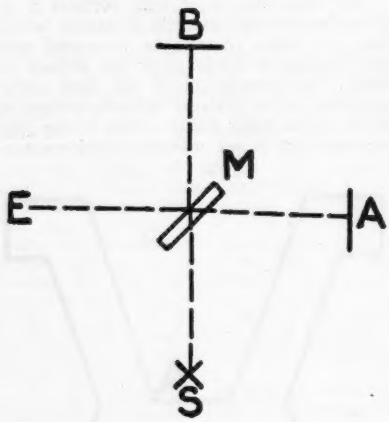


Fig 2.

these are in phase, so that at any given instant the crests of one occur at the same place as the crests of the other, there will be a build-up whereas if the opposite is the case and the crests of one coincide with the troughs of the other, the two will cancel and the result will be darkness.

Let us now suppose that we have two small perfectly plane mirrors with an optical system such as that shown in Fig. 2, where M is a semi-transparent mirror which forms an image of B exactly coincident with A. Then if S is a source of monochromatic light illuminating A by reflection at M and B by transmission through it, there will be two beams of light reaching E, one from A by transmission through M and the other from B by reflection at it. These two beams will be in or out of phase according as the difference between the lengths of the two light paths is equal to an even or an odd number of half wave-lengths. It follows that if A is moved very slowly away from M, the centre of the field of view seen at E will be alternately bright and dark and the number of alternations will be equal to twice the number of half wave-lengths through which A has been moved.

This is the basis of the method originally used by Michelson and Benoit in 1892 and it might be thought that in this way it would be possible to determine directly the number of wave-lengths of any given monochromatic light in the distance between the two marks on a standard metre bar. This is, however, impossible because the position of reinforcement or annulment of the light becomes more and more difficult to determine accurately as the difference in the light path increases and, further, the number of wave-lengths of a suitable monochromatic light in a metre is over 1,500,000 so that counting would take a prohibitively long time and would be subject to grave risk of miscount. On the other hand, a distance of about a millimetre corresponds to only about 1,500 wave-lengths, and twice this number can be counted in a comparatively short period of time and so can be checked and re-checked until the result is known with certainty. In fact, Michelson and Benoit used a distance of rather less than this as their smallest standard and they then built up a series of standards, each double the length of the one before, until they had a standard 10 cm. in length. The distance obtained by moving this standard forward by its own length ten times was then compared with the metre, and the difference was determined in wave-lengths so that finally the number of wave-lengths in a metre was accurately determined. Modifications of this method and refinements have been employed in subsequent re-determinations and the number of wave-lengths of a certain red monochromatic light produced by an electric discharge through cadmium vapour is 1,553,164.12 when the light is travelling in dry air at 15 deg. C. and 760 mm. pressure. These conditions have to be specified since the wave-length of light is inversely proportional to the refractive index of the medium in which the light is travelling and the refractive index of air naturally varies with its density which, in turn, depends on the humidity, the pressure and the temperature.

The particular monochromatic light mentioned in the last paragraph was chosen by

Michelson and Benoit after very careful study of all the sources then available because it was the nearest approach to a "pure" homogeneous light, i.e., one for which the wave-length was most definite, but it has recently been found that an even more precisely defined wave-length is available in the spectrum of an isotope of mercury, viz., 198 Hg. Mercury, as it ordinarily occurs in nature, consists of a mixture of seven isotopes, i.e., substances in which the atoms have slightly different numbers of electrons, although their chemical properties are identical. Each of these isotopes gives its own characteristic spectrum and 198 Hg. emits an exceedingly pure radiation with a wave-length of 0.0005461 mm. This particular isotope can be obtained in a state of purity by the transmutation of gold under bombardment with neutrons in a uranium pile and lamps containing a few milligrams of the isotope can now be manufactured. One such lamp was to be seen on the stand of the Research Laboratories of the G.E.C. at the Physical Society's Exhibition last April.

In conclusion, it is perhaps worth mentioning that there is no suggestion that the unit of length should be altered by any amount, however small; the change from a bar standard to a wave-length standard, when it comes, will be made solely for the purpose of maintaining the existing unit of length to the highest possible accuracy.

The British Electric Power Convention, 1950

A brief report on the second B.E.P. Convention held at Harrogate last month.

The 1950 B.E.P.C., at Harrogate, was an undoubted success, at least so far as this reporter is concerned. From the viewpoint of one with, perhaps, an over-jealous eye on the attention paid to lighting matters, it is stimulating to be able to report that lighting occupied a full and fair share of the proceedings. In fact, it "stole the show" in the form of a paper on "Lamps and Lighting," given by Mr. L. J. Davies, at the Royal Hall. The gist of Mr. Davies's paper has been well publicised, and most lighting men will have seen the Press reports, but only those fortunate enough to be there at the time can fully appreciate the effect produced by the galaxy of good demonstrations, perfectly timed, and accompanied by a speaker with a sparing but precise choice of words, who has at his finger-tips both his subject and his audience. Of course, lamps and lighting, as a subject of a convention paper, does undoubtedly present opportunities of dramatic effect denied to most other subjects, but it is significant that lighting *per se* for a change had a fair showing and, what is equally significant, the subject of lighting promotion in the supply industry was well to the fore in subsequent discussion. There were more good things said on this question, enough to leave the author with the feeling that the supply side of the industry was at last awake to the possibilities of load development by active lighting promotion.

The exhibition, as usual, was an excellent show, and its location in the sun colonnade of the Valley Gardens, though viewed initially with considerable foreboding (at first glance it appeared an impossibility) in fact proved admirable. Lighting was well to the fore, though the sun really stole the show with displays of the new silica-coated lamps and coloured fluorescent lamps running a good second. Lighting fittings, particularly fluorescent, as usual made a brave show, and a new street lighting lantern with an all transparent (including ends) "Perspex" cover looked brobdingnagian and impressive. It was a little disappointing to observe yet again the preponderance of 5 ft. and 4 ft. fluorescent fittings as compared with fittings for the smaller sizes of fluorescent lamps, and it looks as though we must wait longer yet for the simpler, more homely, fittings made to suit the taste and the purse of the man in the street. (Will the manufacturers ever wake up to the realisation that fluorescent lighting has an even greater future in the domestic field than in the field of the large users?)

A feature of particular interest to lighting

E.L.M.A. Lighting Service Bureau Stand at Harrogate.

men was the insertion of vertical louvres in the rear walls of the stand shells backing on to the gardens, which combined the joint functions of ventilation and a limited degree of daylight control.

The Lighting Service Bureau stand deserves separate mention as the only stand representing lighting *per se*. Essentially designed to put over the lighting story, it bravely featured the applications of coloured fluorescent lamps and, considering its position under the great glass dome, it did succeed in portraying luminous colour effects remarkably well. A shop window display of ideas for active lighting promotion in supply and other showrooms included a simple but effective method of back projecting a continuous slide film which might well become a regular showroom promotional feature. Altogether, the stand tied up happily with the prevailing mood for more active lighting development by the supply side, but perhaps the very restraint which accompanies good lighting and good stand design, was responsible for the aesthetic merits of the display, to some extent diverting interest from the very concrete suggestions it offered. Perhaps a means can be found of arousing, in a purely lighting display, the close attention it warrants, but against the competition of manufactured goods on display it is no easy problem.

There was, in accordance with tradition, some pretty floodlighting to see during the convention period. The Royal Bath, in its red and green discharge floodlighting, looked other-worldly (and none the worse for that), while the Municipal Buildings, floodlit in sodium, looked impressively normal. Good attempts were made at tree lighting by both filament and red discharge lamps. The effect in the latter case was clearly not to the taste of the realist group, but perhaps floodlighting has a greater function than that of mere realism.

In general, the exterior lighting conformed to the previous post-war pattern of token installations carried out with stock equipment. It is pleasing to hear, however, that funds have been voted for more ambitious floodlighting to be installed later in the year, and we can be sure that the convention floodlighting contributed in no small measure to this development.

Simulating Aircraft Landings in Fog

By J. W. SPARKE, B.Sc., and H. F. RINGE

In a recent paper to the I.E.S. on Visual Aids for Landing in Bad Visibility, Mr. E. S. Calvert referred to an instrument known as the cyclorama, which was developed at the R.A.E. to simulate the views which the pilot can see during approach and landing. The following article is a description of the apparatus written by the inventors.

The landing of an aircraft under conditions of low visibility may be considered to consist of two stages. The first stage, which may start several miles from the landing point, is flown entirely by reference to instruments and radio aids. The second and final stage of the landing is made largely by visual reference to the ground. The instruments and radio aids now in general use enable the pilot of an aircraft to fly blind to within about ½ mile of the runway or down to a height of about 200 ft. on the standard 2½ deg. approach path. If, when the aircraft reaches this stage in the approach, the pilot cannot see the runway due to low visibility, it is necessary to provide visual information on the ground in the form of an approach lighting system. The greatest risk of serious accident arises at the time of transition from instrument to visual flying and it is, therefore, of the utmost importance to provide the best possible visual aids.

Full scale flight testing of approach lighting systems cannot readily be used as the basis for experimental work in this field for the following reasons:—

(a) The infrequency and changeability of naturally occurring fog and the fact that this major factor of atmospheric attenuation is not under the control of the experimenter.

(b) The high degree of danger in making experimental fog landings in aircraft.

(c) The high cost and protracted nature of such full scale experiments.

One method of attack on this type of problem, by means of mathematical analysis and perspective diagrams, has been developed by Calvert.* This method, however, although invaluable for making a fundamental analysis of visual aids, is essentially a static method, i.e., it deals with the interpretation from a point fixed in space, and it is not possible to include the effect of continuous forward motion of the observer. This difficulty disappears if a simulator can be constructed to present to an observer a realistic picture in true perspective which changes just as the pilot's view of the actual visual aid changes in accordance with his motion. This article describes such a device designed and built at the Royal Aircraft Establishment in 1947.

This simulator has made a major contribution in obtaining agreement on approach lighting policy in this country, as it has enabled technicians and administrators to appreciate some of the difficulties confronting a pilot when landing in bad visibility. Recently, the simulator has been used to make some fundamental investigations into the nature of the visual processes used by the driver of a fast moving vehicle.

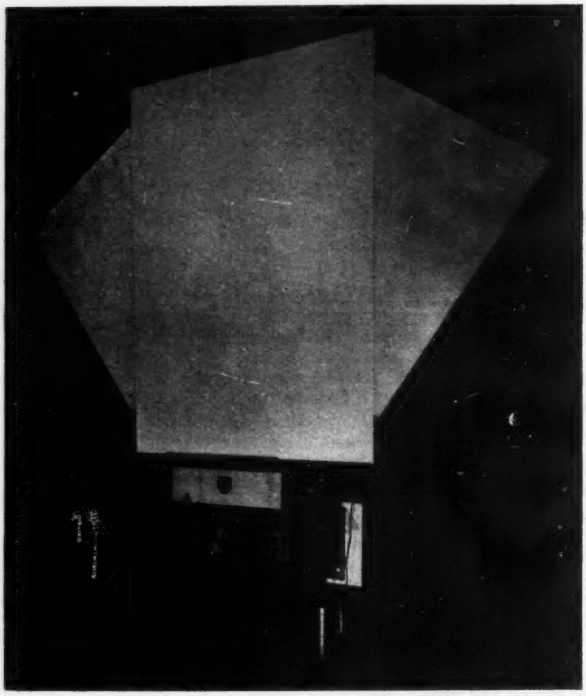
General Principles

The pattern of the ground lighting system or other visual aid is reproduced 1-150th full size on a white screen by means of optical projection from a slide. This screen represents the ground plane, and it is viewed obliquely in the same way as the ground is

The authors are at the Royal Aircraft Establishment, Farnborough.

* (1) "Visual aids for low visibility conditions." Journal of Royal Aeronautical Society, July, 1948.

(2) Paper read before I.E.S., April, 1950.



Showing general view of screens.

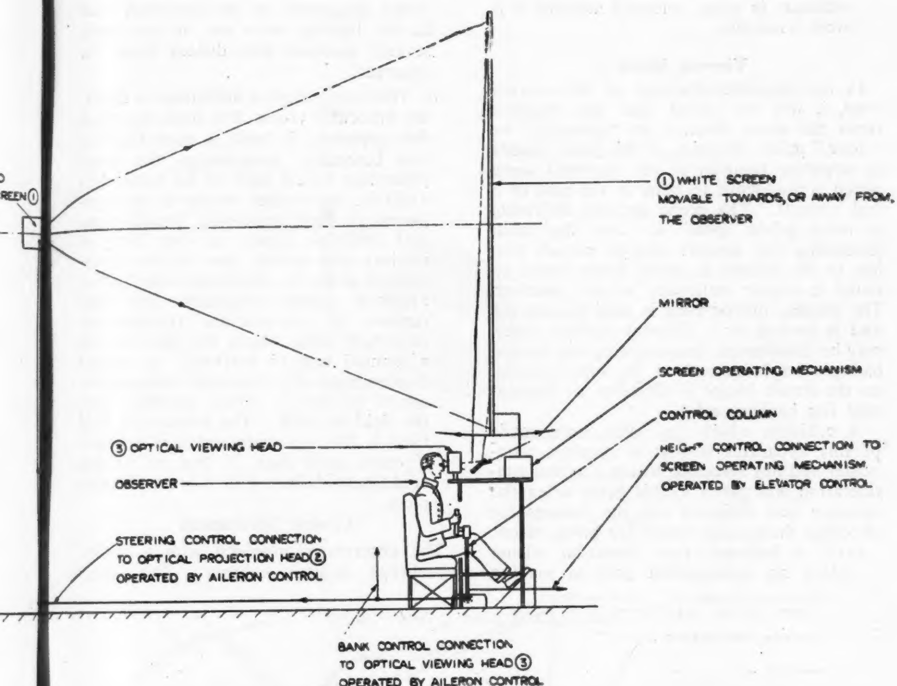
viewed from an aircraft. The image on the screen is viewed through an eyepiece incorporating a mask which limits the observer's field of view to that from the pilot's position of any particular aircraft. An observer, therefore, sees a picture in which all relative distances and angles are identical with the full-scale scene. Forward motion of the observer is simulated by causing the image on the screen to move in a direction towards the viewing position. Movement of this image depends upon how the observer operates the steering control provided. A height control changes the perpendicular distance between the viewing point and screen. The observer, therefore, has three-dimensional control over his apparent forward motion as a pilot has in an aircraft.

The effect of banking the aircraft is simulated by an optical device incorporated in the eyepiece. Fog is simulated by attenuating the light forming the more distant part of the image on the screen by means of a rotating sector disc in front of the projector, and by introducing a veiling haze between the observer and the screen.

In the illustrations it will be noted that the screen representing the ground plane is vertical for convenience in projection, but a mirror at 45 deg. placed behind the eyepiece causes it to appear in the horizontal plane to the observer.

Optical Projection Head

The arrangement used is that of the conventional magic lantern with a lens-condensing system and a force-cooled 2-kw. tungsten filament lamp. Spaced some inches in front of the objective lens is the rotating sector disc used to simulate atmospheric attenuation. The apertures in this disc are shaped in such a way that the screen brightness is maximum near the observer, and decreases gradually to zero at maximum range. The hub of the disc is on the line joining the optical centre of the objective lens, and the eyepiece and the position of the centre of the disc along this line determines the apparent fog density.



General arrangement of cyclorama.

Slide Motion Control

As shown in the illustration, the slide control mechanism consists essentially of a pair of three-wheeled carriages mounted so that their wheels are in corresponding positions on either side of the slide. The wheels are rubber-tyred and the carriages are so mounted that sufficient pressure is applied between pairs of wheels to grip the slide. One of these pairs is mounted so that it may be swivelled about an axis perpendicular to the plane of the slide. One wheel of this pair is driven by a small electric motor, and so imparts forward motion to the slide.

This arrangement permits the slide to be steered as it moves across the optical gate of the projection system, and thus produces a corresponding motion of the image of the slide on the screen. The steered wheels are controlled through suitable mechanisms by the operator's controls in such a way that the screen image moves in the same way as the ground appears to move when an aircraft makes a turn of corresponding magnitude.

This form of slide motion control also lends itself to the simulation of drift or crabwise flight. This may be done with sufficient accuracy by rotating the complete double-carriage assembly through an angle equal to the angle of drift.

Slides of two forms have so far been used:—

(a) Thin sheet metal slides which have small holes drilled to represent lighting units. These are seen on the screen as small light sources against a dark background simulating lighting systems under night conditions. Colour may be introduced by sticking coloured cellophane sheets over the holes in the slide.

(b) Photographic transparencies representing ground areas such as runways with painted markings. These simulate day-time conditions. At present only black and white photographic material has been used, but there would be no

difficulty in using coloured material if it were available.

Viewing Head

In the schematic diagram of the viewing head, it will be noted that the observer views the scene through an "erecting" or "dove" prism. Rotation of this prism causes an apparent rotation of the observed scene which is analogous to bank in the case of a real aircraft. The scene appears to rotate at twice prism speed so that the mask simulating the aircraft cockpit cut-off also has to be rotated at twice prism speed to make it appear stationary to the observer. The 45 deg. mirror used is semi-transparent and is backed by a diffusing surface which may be illuminated, thus enabling any desired background brightness to be superimposed on the screen image to simulate an illuminated fog background.

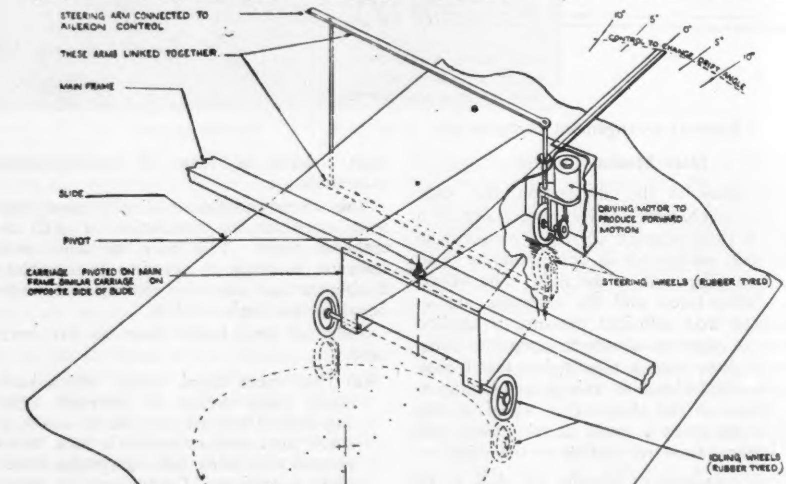
A criticism which has often been made of this apparatus is that it employs monocular and not binocular vision. Careful consideration was given to this point when the eyepiece was designed and the reasons for choosing monocular vision are given below.

(a) It is believed that binocular vision plays an unimportant part in making visual judgments in the approach zone as the lighting units are, in the main, several hundred feet distant from the observer.

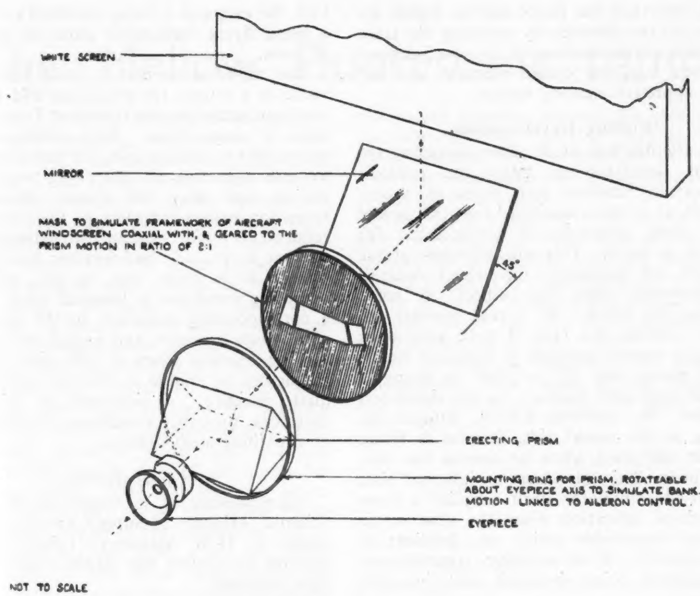
(b) There are practical difficulties in applying binocular vision. The scale on which this apparatus is built is such that for true binocular presentation the pupil separation would have to be reduced to 0.020 in. by optical means in the eyepieces. This separation would mean that artificial pupils in the form of vertical slits would have to be incorporated and these would seriously reduce apparent screen brightness and also remove all eye-position freedom—an important point where the observer has a manual task to perform. A further disadvantage of a binocular arrangement would be that it would seriously limit the field of view. The monocular field used is 100 deg. wide and it is doubtful if much more than 30 deg. or 40 deg. could be obtained with a binocular eyepiece.

Control Mechanism

The observer is provided with a normal wheel-type control column. The wheel



Showing slide motion control.



Optical viewing head arrangements.

control, which is hydraulically damped to give it "feel," is mechanically linked (through a device to produce a lag corresponding to aircraft inertia) to both the viewing head for rotating the bank simulating prism and to the pair of steering wheels in the projection head. Operation of the wheel control therefore causes an apparent banked turn, both the degree of bank and sharpness of turn being proportional to the deflection of the wheel.

Fore and aft motion of the column, which is also hydraulically damped, controls an electrical actuator, which moves the screen representing the ground plane. By this means movement of the column causes the screen to be driven either toward or away from the eyepiece according to whether the column is pushed forward or pulled back. Movement of the screen away from the eyepiece is equivalent to gaining height, and vice versa. The rate of climb or descent is proportional to the displacement of the control from the neutral position.

Forward speed may be varied by altering the speed of the electric motor driving the slide. On the present apparatus this control is not in the hands of the observer and may be varied only by the projector operator.

Recording Equipment

Recording gear is used for plotting the plan and elevation of the imaginary path flown. The records are made on recording voltmeters by applying a voltage which is proportional to height in the case of the elevation record and to deviation from the centre-line in the plan record. A voltage proportional to height is obtained by linking the slider of a potentiometer to the screen representing the ground. This potentiometer also drives a remote indicator to enable the projector operator to see the height represented by the screen at any time.

The plan indication is picked up by means of a pair of arms which bear upon the edges of the slide in the projector. These arms are mechanically linked to a potentiometer in such a way that its slider reproduces the lateral motion of a point on the slide corresponding to the plan position of the observer. The voltage from this potentiometer is fed into the recording meter.

Both recording meters have a constant

speed drive for the paper charts, which are calibrated for distance by marking the trace at points corresponding to two well-defined positions, e.g., the commencement and end of an approach lighting system.

Further Developments

No attempt was made when designing the present simulator to make the controls identical in function with those of a real aircraft, as it was considered that this would make them unnecessarily complicated for the job in hand. This simplification of the controls (in particular the wheel control) has, however, been the subject of some criticism by pilots. In a real aircraft the wheel controls the rate of roll, and when it is in a central position it does not necessarily mean that the aircraft is flying a straight and level course. In the simulator, however, the operator knows, without referring to the visual aids, that he is flying straight and level when he centres the control wheel. This introduces an inherent bias, in that the simulator itself supplies a form of horizon indication when the observer is viewing visual aids which are deficient in this respect. More realistic controls are consequently being designed, and, in addition, the eyepiece is being modified to include a blind flying instrument panel in the field of view.

The modified simulator could also be of value as a trainer for practising bad weather landings, including the transition from instrument to visual flying. With continuous improvement in landing aids, the trend is always towards operating aircraft under poorer conditions, and since the danger during the transition period increases as the visibility is reduced, it will become increasingly important to provide bad-weather training for pilots. It is clear that as the minimum operating condition is lowered there will be a corresponding reduction in the frequency with which it occurs, and a stage will eventually be reached when it will occur too infrequently to enable a pilot to obtain adequate practice. A simulator of this type, therefore, probably constitutes the only way of providing such practice.

Acknowledgments

Acknowledgment is made to the Chief Scientist, Ministry of Supply, and to the Controller of H.M. Stationery Office for permission to publish this paper. Crown copyright reserved.

C. and G. Courses

For the past three years the Manchester College of Technology have held a one-year course leading up to the Intermediate Certificate in Illuminating Engineering of the City and Guilds of London Institute. The syllabus has now been expanded and the College authorities have decided to devote two years to the course in order to provide instruction in the basic subjects which are often in need of revision as well as to cover the syllabus more fully. The lecturers include two members of the Manchester Centre of the I.E.S., Mr. H. Hewitt, A.M.I.E.E., and Mrs. I. H. Hardwich, M.A., A.M.I.E.E. Lectures for both the first and second year courses will be held on Monday and Tuesday evenings. Enrolment for the course will take place at the College in late September or early October.

Beginning in September a course will also be available in Northern Ireland where Mr. R. W. France will be running an evening course to prepare students for the Intermediate exam. in the following May. Full details of times, etc., have not yet been fixed but those interested should communicate with Mr. R. W. France at the Dept. of Electrical Engineering and Physics, College of Technology, Belfast.

Details of courses in London and elsewhere will be published shortly.

Conference on Production

On November 15 and 16 the Utilisation Section of the Institution of Electrical Engineers are holding a conference in London on "Electricity as an Aid to Productivity" in order to make available to industry the most up-to-date information concerning the contribution that factory electrification can make to the country's efforts towards increased production.

The conference is mainly intended for those executives in both large and small factories who are responsible for production, and will consist of a series of lectures each of which will be followed by a general discussion. It has been planned, as far as possible, from the point of view of the user, and the lectures will therefore cover, in general terms, what electricity can do to increase production rather than give full technical details of the apparatus with which these improvements can be achieved. The subject matter of the lectures will come under the following broad headings: (a) Motive power in the factory, (b) Industrial heating processes, (c) Welding applications, (d) The handling and inspection of materials, and (e) Lighting, heating, ventilation, etc.

The proceedings of the conference will be published.

The Mellow Fluorescent Lamp

The Electric Lamp Manufacturers' Association have recently introduced a new fluorescent lamp colour to which the name "Mellow" has been given. The various lamp colours now available from the E.L.M.A. firms are : Colour Matching, Daylight, Natural, Warm White and Mellow.

These lamps form a series designed to cover the present range of uses of the fluorescent lamp. Although they have been introduced gradually over a number of years as the usefulness of the fluorescent lamp has been extended, it will be seen by reference to Fig. 1 that their colours represented on the C.I.E. chromaticity diagram fall roughly on a line intersecting the black body locus at about 6,500 deg. K. and lying on the purple side of the locus for equivalent black body temperatures lower than the intersection point. While the Warm White lamp, which is the nearest in colour to the new Mellow type, admirably filled many needs, it had been appreciated for some years that for intimate, social, domestic and commercial uses there was likely to be an increasing need for a definitely warmer light than the so-called "Warm" colour, and experiments conducted both in the field and on a wide scale in the various lamp research laboratories indicated that the desired effect could be produced with modern fluorescent powders without the sacrifice of the excellent blue rendering qualities of the halo-phosphate type of powder. No beryllium compounds are used in the manufacture of any of these lamps.

After trials extending over several years and including very many different variants of both hue and colour rendering properties, it was decided to standardise on a colour which is shown diagrammatically in Fig. 2 and of which the objective chromatically co-ordinates are x .462, y .377.

For comparison purposes the objective chromaticity co-ordinates of the range of E.L.M.A. fluorescent lamps are given in the table below:—

Lamp	Chromaticity Co-ordinates		
	x	y	z
Colour Matching	.313	.323	.364
Daylight ...	.363	.365	.272
Natural ...	.371	.349	.280
Warm White ...	.434	.380	.186
Mellow ...	.462	.377	.161

In considering the colour of any fluorescent lamp it must be appreciated that there is an intimate relationship between the colour

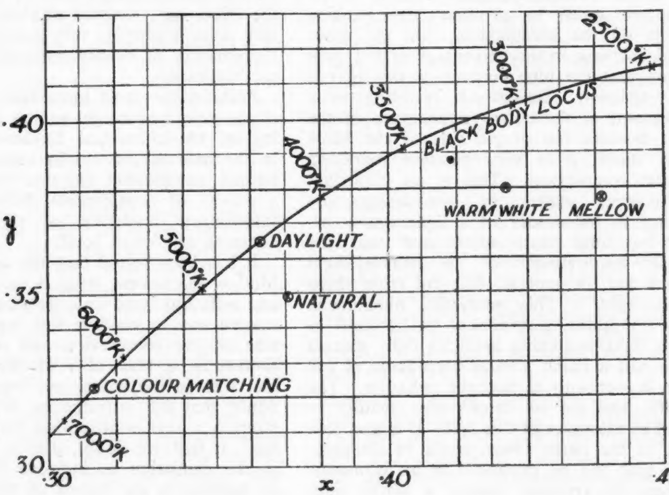


Fig. 1. Chromaticity co-ordinates of fluorescent lamps compared with black body locus.

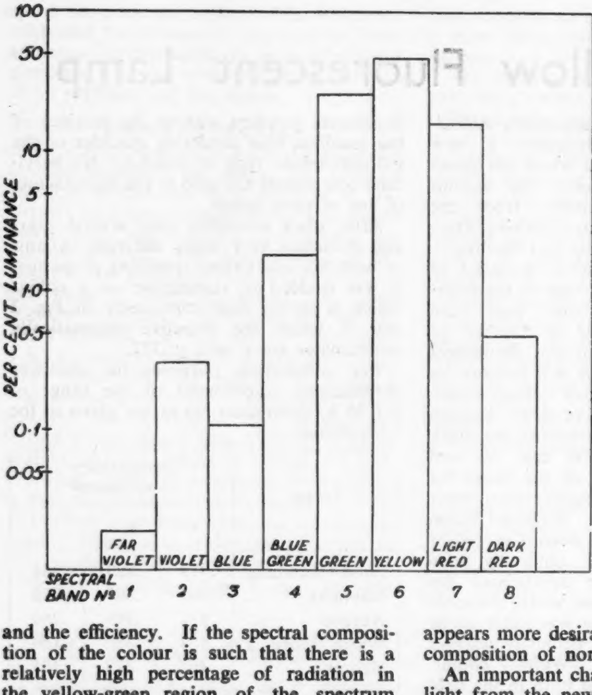


Fig. 2. Spectral distribution of the Mellow lamp plotted on a logarithmic scale.

and the efficiency. If the spectral composition of the colour is such that there is a relatively high percentage of radiation in the yellow-green region of the spectrum then a high efficiency may be predicted. It has been found, however, that an excessive amount of radiation in these regions of the spectrum tends to produce less pleasing effects on the complexion. On the other hand, increase in the percentage of red, providing that the blue content of the light is not seriously diminished resulting in a movement of the colour appearance of the light towards the purple side of the black body locus, gives very pleasant rendering of the complexion. This is an important sociological matter in considering any change in the colour of a light source.

It has long been appreciated that the colour requirements of an artificial light source are, in general, different from those of daylight. This interesting phenomena has, no doubt, a historical background as from their beginning artificial light sources have had a much greater percentage of red than is met with in daylight radiation. The candle and the oil lamp come readily to mind as examples of this fact. It is also true that at the much lower levels of illumination that can be produced in an economic manner by artificial means a warm light appears more desirable than a light with the composition of normal daylight.

An important characteristic of the mellow light from the new lamp is the fact that it gives to the complexion a very desirable healthy glow. In making the final decision on the colour composition of mellow light, the effect on cosmetics was studied and the new lamp is proving very acceptable for the illumination of beauty parlours and similar establishments.

Perhaps the most important other aspect of the colour of a light source, is the rendering of the colour of foodstuffs. Just as in the case of the colour rendering of the human complexion so, too, has it proved a matter of considerable difficulty to give satisfactory rendering of the colour of common articles of food.

It has been found that the light from the Mellow fluorescent lamp is very acceptable, and sufficient large-scale tests have now been carried out to confirm this view. What is true of the complexion and of articles of foodstuffs is true also of the furnishings met with in the home, and there can be no doubt that the introduction of the Mellow lamp is a real contribution for home lighting. It will, no doubt, play a positive part in the campaign to improve the standards of lighting in the homes of this country.

Correspondence

Home Lighting

To the Editor of LIGHT AND LIGHTING.

Sir,—You were perfectly right in saying in the February issue that home lighting has been very much neglected. Nearly everyone connected with the electric lighting industry is to blame. I am an electrical contractor-retailer and have found that if I light my own home properly one is able to appreciate more fully the atmosphere of good lighting. The following is a brief description of how that atmosphere is engendered in my case. In the dining-cum-living room we find that a 5 x 60 watt fitting with silk shades gives a good general light. This is supplemented by a floor standard and a smaller standard lamp which stands on a set of drawers. On each wall there are lighting switch-socket outlets for use as required. In the lounge we have a six-light saucer fitting in the centre, with two wall brackets, one either side of the fireplace. A floor standard provides light at the piano.

Coming to the workshop of the house, the kitchen, a light is placed over the cooker and also over the table. These are spherical units, a 200-watt and a 100-watt. All doors opening into dark passages are fitted with door switches so that the light comes on immediately they are opened. In the scullery a light is placed in the centre with another over the sink. Outside steps, yard, garage, coal-place, greenhouse, and sheds are all illuminated with switches handy. The front door light is controlled both from inside the hall and from the garage.

In the bedrooms fixed bracket lights are installed over each bed and wash basin, with two-way control for a three light fitting over the dressing table. In the bathroom, centre light and bracket light over mirror are fitted. Lights in passages and staircases are all fitted with two-way switches. In the study a central prismatic enclosed fitting and a table lamp are found very satisfactory.

All the table lamps contain a 100-watt lamp and floor standards two or three 60-watt lamps. A common fault with such standard lamps is the use of the too small lamps which are frequently inadequately screened. In the case described the lamps are well screened with large enough lamp to ensure good lighting. I find that once the need for good lighting has been explained there is no difficulty in persuading the majority of householders to install a good installation—and I can show them my own as an example. There is, however, far too little interest taken by the builder, and particularly the architect in adequate house lighting; it is only when the householder takes over a house that he realises how limited is the scope of the electrical installation. He is then faced with putting in additional lighting points with the house newly decorated, and whilst he is still suffering from the shock of meeting all the expenses in connection with the house. It is common to see in new houses flex wandering all over the place. Do not think for a moment that the average house requires a lot of what one would call "fancy lighting" behind alcoves, plasterboards, concealed here, there and everywhere, with various colours and dust traps. Thousands of homes are lit with bare lamps or with lamps obscured in bowls. It would be as well to give every house adequate lighting with simple lighting fittings and easily detachable shades (many lampholder rings get fixed after six months' use). There is a vast field for improvement in the simple direction. Far too much of our resources has been spent in designing fancy lighting units and thinking of fancy lighting positions which may look nice but which are extremely difficult to keep clean and maintain in a reasonable state. For example, concealed lighting can be really beautiful but it is extremely difficult and expensive to maintain, whilst there are very few positions in the house suitable for its use. Far too many articles and words have been used in extolling its uncertain advantages.

I am sure we shall get more response from the public if we advocate simpler forms of good lighting.—Yours, etc.,

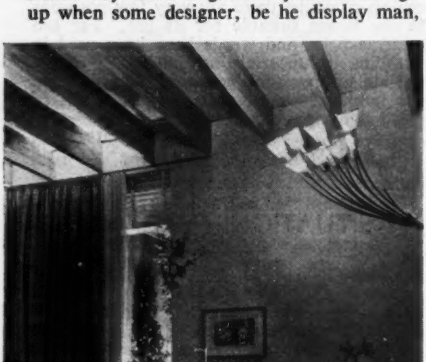
H. F. TRUMAN.

Walsall, Staffs.

Why Jeer?

Some Views on Design and Designers

Speak to any lighting engineer about present-day design of domestic fittings and he will almost certainly deplore the lack of originality, but show him anyone's efforts at introducing a little of this quality and his reactions will, with absolutely no doubt at all, be very far from polite. Since the number of designers of remotely interesting fittings, employed by the better known fittings manufacturers in this country, can probably be counted on rather less than the fingers of two hands, it is hard to understand why such a general jeer should go up when some designer, be he display man, architect or one of "them there furriners," does have a shot at putting forward something a little out of the general run of things.



One of the stands exhibited by the Scottish Furniture Manufacturers at the B.I.F. The fitting is in perfect keeping with the goods displayed.

At the beginning of this year this journal carried a little piece about the C.I.D. Scottish Committee's Exhibition of European Lighting Fittings, which is typical of the sort of thing that happens. Two excellent British designers were, to quote, to "be congratulated on having made even the most unwieldy lighting contraptions seem at home." The settings, which were charming by any standards, were described as "displays of bric-a-brac, old china, succulent plants and modern furniture," and if you cannot hear the sneer on that word "modern" we certainly can.

The lack of British fittings in this show was furthermore described as "a confession that we are not at present generally producing lighting equipment up to the aesthetic standard set by the Council of Industrial Design," and again the tone of voice on "aesthetic" is unmistakable. Now your present author has now and then in the past, both in public and private, been exceedingly rude about the Council of Industrial Design, for at times they have in his opinion been more than a little silly, but without in any way trying to curtail the free expression of honest views, he does feel that for the average lighting engineer to adopt the view that everything the C.I.D. does is a lot of aesthetic nonsense is very wrong indeed.

The Council of Industrial Design is a good thing. The shows it sponsors are *always* examples of educated good taste, and if at times it does give evidence of not knowing all about everything, it is well to remember that very few people do. The chief trouble lies in the fact that there is so little common language between the electrical industry's lighting fittings designers and designers of

the type associated with the C.I.D. and, as in all cases of language difficulties, it is so easy to create misunderstandings. Think, if you can, of a single large fittings' manufacturer who employs someone who does know this language, and it is highly probable that your mind will produce nothing. They are there, however, the very meagre few and they are to be most warmly congratulated. If jeer we must, then let us jeer at the fact that there are not more of them, but at the same time remember that employing a man who has good "design" qualifications is not by any means the whole story. He has to be given sufficient freedom to allow him to apply his ideas, and this, perhaps, is the hardest task of all.

Tradition dies so very hard. This or that line has sold well for years and the old hands at the game are always very loath to experiment with something new. So for that matter is the public, but the sort of companies we have in mind have means of persuading the public. Out of the vast advertising allocations it should surely be worth while to set aside a little more to be spent on encouraging the public to buy the better type of fittings, for without this Press support the chances of anything new "getting over" are very slight indeed. They will certainly never exist at all if left to the unassisted endeavours of provincial salesmen working through local retailers.

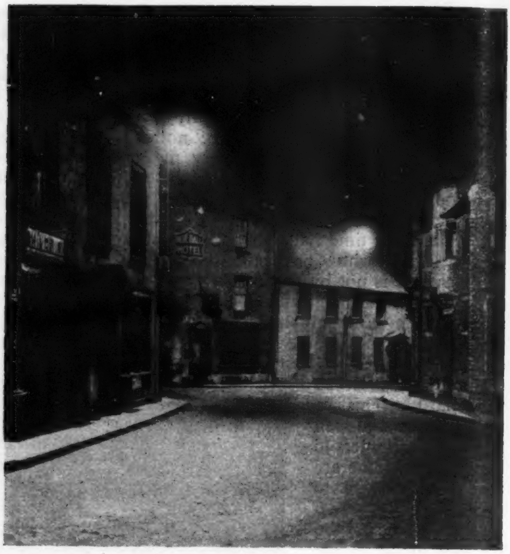
Terror of the new is depressingly ubiquitous and the illustrations to this article are excellent examples of the sort of thing we have in mind. Indeed, if you have not already thought or said something highly derogatory about them you are almost certainly not an illuminating engineer. The slung "hunting horn" fitting is, of course, the one likely to cause the rudest remarks but in its context it was right. Both these illustrations are from the stand of the Scottish Furniture Manufacturers at the British Industries Fair and this particular fitting was from a room deliberately calculated by its designer, Jacques Groag to have a moorland feeling. The ceiling fittings used in the bedroom are also worth noting. Certainly they were made up of bent slats of wood and equally certainly they would collect dust, but what doesn't, and if the paper shades of the bedhead fittings do this too, is this so strong an argument against them if their appearance is pleasant and their lighting performance satisfactory? If the ignoramus can think of nothing else to say he will pick on dirt, and to hear him one is tempted to feel that cleaning in any shape or form has gone out of fashion.

"Good" designers would do very well, too, not to jeer at the products of the lighting fittings manufacturers, for from them they have a lot to learn. Mistakes the lighting boys may make. Good illuminating engineering may get embellished by what the engineer considers decoration or sales appeal and the result may be quite horrid, but let it not be forgotten that the good engineering does exist. As long as an illuminating engineer designs a lighting fitting to do a particular job it is certain to have much in its favour, for it is hard indeed for true functionalism to fail, but it is outside this sphere that the harm is done and that the help and co-operation is so badly needed. Both sides must stop put-

(*Continued on p.* 274)

This bedroom interior designed by R. D. Russell and R. Y. Gooden was another of the stands at the B.I.F.

Recent Street Lighting Installations



When the Class A road through Bruton, Somerset, was recently relighted it was found that the narrow pavements in this old world village made the use of columns for mounting undesirable except in the cases of six of the 22 lanterns which comprise the scheme. The remainder, therefore, are sited on wall brackets, and a mounting height of 25 ft., with spacing at 120 ft., is maintained throughout the installation. "Mazda" Urban Enclosed lanterns are used, each housing a 250-watt vertical burning mercury vapour lamp.

Metrovick street-lighting has recently been installed at Stevenage to light the Great North Road, which forms the main thoroughfare of the town. "S.O. Fifty" lanterns, using 140-watt sodium discharge lamps, have been erected on concrete columns which have a special red finish to blend with the red brick of the surrounding premises.

The first installation of fluorescent street lighting in Israel is now in operation at one of the busy squares in Haifa. The installa-

(Above). Mercury lighting at Bruton, Somerset.

(Left). Sodium lighting at Stevenage.

Experimental fluorescent lighting at Pine Square, Mount Carmel, Haifa.

tion, planned by the Municipal Electricity Department, comprises four B.T.H. three-lamp lanterns suspended on catenary wires across the 35-metre wide square. The average illumination in the square has been raised to 0.3 lm./ft.[2]

An installation of sodium street lighting at Mansfield Woodhouse comprises 22 G.E.C. lanterns constructed of die-cast alloy with prismatic refractors cemented to the inner surface of the Perspex bowl. The units are equipped with 140-watt sodium lamps, and are spaced at approximately 130 ft. The installation was erected by the East Midlands Electricity Board.

Sodium lighting at Mansfield Woodhouse.

Problems in Illuminating Engineering For Students

By S. S. BEGGS. M.A., F.I.E.S.

II. Street Lighting

As indicated previously, the modern technique of street lighting in Britain differs from that of the majority of lighting applications; the reason is that the directions of incidence of the light and of viewing the street surface are in general so nearly parallel to this surface that the reflection characteristics are far from matt, and the brightness distribution in the field of view bears no direct relationship to the illumination values. It is only the rough proportionality of brightness and illumination of surfaces in most installations that has enabled satisfactory installations of any kind to be planned on a basis of illumination values; in street lighting the illumination distribution is of little significance, and the installation has to be planned on a basis of *brightness* distributions.

By studying and making use of the reflection characteristics of road surfaces at large angles of incidence and of view, not only may dark areas on the roadway be avoided but the brightness of the whole surface may be increased, thereby increasing the contrast between objects on the road (which nearly always appear dark) and their background and improving the standard of visibility. It is very important that the student should appreciate the shape and extent of the area of road that is rendered bright to a driver on the roadway by each lantern, and its dependence on the light distribution from the lantern; this bright area—not the span between successive posts—is the unit from which the successful street lighting installation is built up.

Recommended practice for street lighting in Britain is detailed in the Final Report of the Ministry of Transport Departmental Committee on Street Lighting, published in 1937. The main recommendations should be known, with a good appreciation of their basis. (The latter is as important as the actual values quoted in the report.) Some knowledge should be obtained also of more recent work, on items such as cut-off lighting installations, roundabouts and one-way traffic routes. The student should be able to indicate the reasons for his proposals for a scheme in answer to a question; he should also be able to discuss the advantages and disadvantages of different types of installation, and of different light sources. This will require a study of the economic and aesthetic as well as the technical factors affecting a street lighting installation.

As the success of the installation is affected very appreciably by the characteristics of the lantern, typical forms of lanterns should be considered in relation to both their construction and light distribution.

Attention should not be concentrated only on the lighting of traffic routes. Amenity lighting (of squares and promenades) and the special problems of wide roads must be borne in mind. Some knowledge is desirable of street lighting auxiliary equipment, e.g., guard posts and road signs, and especially of information of a fundamental character, such as their position or legibility. The street lighting engineer has a wide field to cover, and his position is one of special responsibility to the public.

The first article in this series appeared in Vol. XLII, No. 9. September, 1949.

Question 20 (1947)

Design the street lighting for the following roundabout:—

*Central island: circular—*100 *ft. diameter.*

*Carriageway around island—*30 *ft. wide.*

Main roads enter due North and South. These have double carriageways, each of 30 *ft. width with a* 10-*ft. central reservation and* 10-*ft. pavements.*

Main roads enter N.E. and S.W. These are 30 *ft. wide with* 10-*ft. pavements.*

Give as full details as possible of lanterns used, including light distribution, spacing, mounting height. Bear in mind the Ministry of Transport Report recommendations. Carry the road lighting back 400 *yards from the centre of the roundabout.*

Answer

The basic principle in the layout of the installation is the location of the lanterns to reveal the presence of the junction from a distance and to provide a bright background against which other traffic and

pedestrians and the position of the kerbs may be seen by a driver approaching and making his way through the roundabout. The route to be followed should be easily recognised, and a confusing array of lights is to be avoided. A suitable scheme is shown in Fig. 8, on which is also indicated the traffic which each lantern serves.

All lanterns are mounted at a height of 25 ft.; a non-cut-off light distribution would be used throughout in this instance, although sometimes a cut-off distribution is advantageous for lanterns on the perimeter of the roundabout (e.g., at B).

A lantern should be placed on the island in line with each lane of approaching traffic, but not too far from the perimeter. Normally the intersecting roads are brought in at a greater angle and a lantern is required for each. In this case, however, one lantern may be arranged to serve both a double- and a single-carriageway road. The two lanterns at AA in Fig. 8 serve to warn approaching traffic on any of the four roads of the presence of the roundabout, and will reveal traffic or pedestrians crossing the end of the approach road or turning into it. These lanterns should have a symmetrical light distribution, and would be equipped with a 250-w. H.P.M.V. lamp; a slight advantage may be gained by fitting a shield on the island side of each to ensure that no confusion exists regarding the route to be followed.

Two lanterns placed at BB show up the edge of the kerb at the corner of entry into the roundabout, and that of the central island on the offside. They also reveal both traffic entering just ahead (from the single-carriageway road) and that approaching from the right round the island. These lanterns would also be symmetric units, using 250-w. H.P.M.V. lamps.

Each carriageway of the double-carriageway road would be treated separately, but economy in posts would be effected by mounting two lanterns on 5-ft. bracket arms from those on the central reservation. These would be at about 280 ft. spacing, and lanterns would also be mounted above the outer kerbs at intermediate positions to provide a staggered installation of about 140 ft. average spacing on each carriageway. The first lantern, C, would be on the central reservation, at about 60 ft. distance from its end, to show up the kerb at the exit corner into this carriageway and to reveal pedestrians crossing here. It also silhouettes the kerb of the island for circulating traffic approaching the position B.

In order to avoid an apparent galaxy of

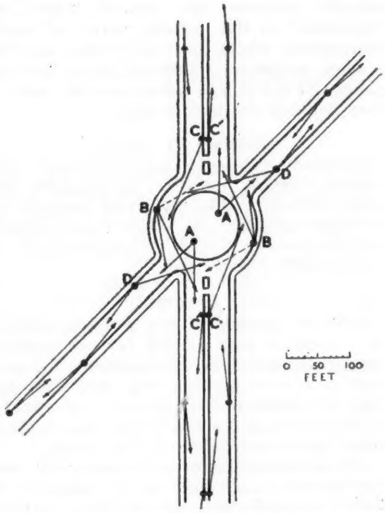


Fig. 8. Layout of installation for a roundabout.

lights and to increase the revealing power of the installation while reducing power consumption, unidirectional lanterns may be used with advantage on this road. These would have the usual light distribution in the direction facing the traffic, and would be equipped with 125-w. H.P.M.V. lamps, providing a maximum intensity of about 2,000 candles at 80 deg. to the vertical.

The single-carriageway roads would be provided with a normal staggered installation of lanterns at about 140 ft. spacing. The first lantern, D, would be on the offside to traffic turning out of the roundabout, to reveal the kerb at the exit corner and pedestrians crossing the road, in the same way as C acts for the double-carriageway road. It also serves to reveal traffic entering from the latter and to show up the kerb of the island to traffic continuing round the roundabout from the neighbourhood of B. A type of lantern providing a non-axial asymmetric light distribution would be used; equipped with a 250-watt H.P.M.V. lamp a maximum intensity of about 2,000 candles would be obtained and a light output of about 6,000 lumens from the lantern.

The roads are unlikely to continue dead straight for 400 yards from the roundabout. The staggered system would be used on

straight portions, but lanterns would be transferred to the outside curve of each carriageway where the road bends, and the spacing would be shortened, using a siting gauge, to avoid too great angular separation between the light sources.

Question 21 (1943)

Tungsten filament, sodium vapour and mercury vapour lamps are all available for street lighting. Which do you consider to be most suitable and which least suitable for this purpose? Give detailed reasons for your order of preference.

Answer

It is not possible to give a simple answer to a question such as this, for the requirements, and therefore the preference for one light source or another, will vary with the type of installation considered; but a study of the merits of the different sources enables some broad conclusions to be drawn.

The discharge lamps are more costly, but the increased cost tends to be balanced by their increased efficiency and life. Where electricity is cheap, the operating cost of an installation is much the same for all these sources, but for average charges for energy the more efficient discharge lamps are more economical. Capital costs of an installation are higher for the discharge lamps; these are more than counter-balanced in the larger installations by the reduced maintenance and energy costs, but for lower power installations (for Class B roads) the simplicity and cheapness of the filament lamp and equipment puts it at a considerable financial advantage at present, although the H.P.M.V. lamp is a strong competitor.

The delay in attaining full light output from the sodium and high pressure mercury vapour lamps is not important in street lighting, as the lamps are switched on before dusk, and the supply is usually not interrupted. The susceptibility of the mercury vapour lamps to low supply voltage and temperature problems are normally adequately covered by a good design of the auxiliary gear and the lantern. In ordinary circumstances these are not practical disadvantages but may be in extreme cases.

The relatively low power of the maximum rating of sodium vapour or mercury fluorescent lamp available handicaps their use for the more powerful installations. Their low brightness may have some advantage regarding glare, but it is off-set by the size of the source required for a useful light output, which entails fairly large lanterns and reduces the degree of control attainable in the light distribution. The small size of the filament source is a considerable advantage in this respect.

The importance to be attached to the colour of the light varies with the installation. The monochromatic rendering of the sodium lamp is not necessarily objectionable, although the visibility may be reduced somewhat on account of the total absence of contrast due to colour. On an arterial road colour matters very little, but in a civic centre the colour rendering should not be markedly unnatural. The cost of cable and energy and low rateable values demand maximum efficiency of the source for the former, and sodium or H.P.M.V. lamps are very desirable; in the latter high power filament lamps are preferable, but a mixture of filament and H.P.M.V. lamps may be used effectively in diffusing fittings where the surrounding buildings are tall and not too dark. In shopping centres spill light from the displays and luminous signs will sometimes correct the appearance of pedestrians, but reliance should not be placed on this assistance. Low pressure mercury vapour fluorescent lamps may be used in squares or public centres, but the design and location of the fittings require very careful consideration, in order that the appearance by day may be pleasing.

It will be apparent that it is not possible to give a single order of preference for the light sources quoted. In broad terms the most desirable choice would be: (1) H.P.M.V. or sodium vapour lamps for arterial roads in open country, where high efficiency and good control of the light are of most importance, (2) H.P.M.V. lamps for traffic routes in built-up areas, (3) high power tungsten filament lamps, possibly with H.P.M.V. lamps in addition, or sometimes low pressure mercury vapour fluorescent lamps in civic centres, (4) low power H.P.M.V. lamps for secondary (Class B) roads used appreciably by traffic, and (5) tungsten filament lamps for residential estates.

(*Continued from p.* 269)

ting their tongues out over the garden wall. They both have so very much to commend them and if only they will cut out this sad self-conscious attitude of non-co-operation and really try to find a common tongue in which they can understand each other, it is just possible that we shall see sufficient good fittings one day, at no higher prices than the bad ones, to give the public the opportunity of getting to know them well enough not to be frightened any more.

New Lighting Installations

Laundry Lighting

The racking room in Hounslow Model Laundry, Ltd., has recently been equipped with Benjamin Type "FF" Flurolier Reflectors each containing a 5-ft. 80-watt lamp.

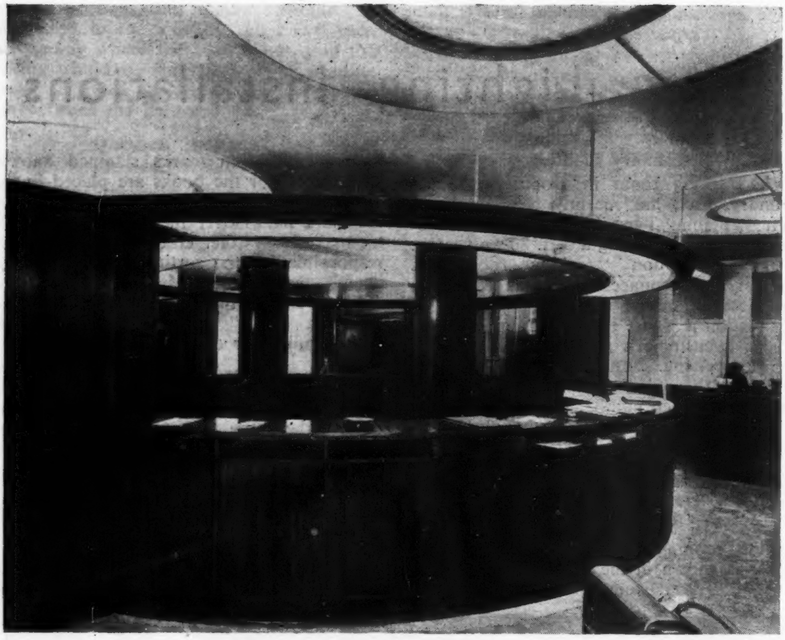
The description "racking room" is familiar to all connected with laundries, but for those unfamiliar with laundry processes this section is where the various pieces comprising a customer's parcel are reassembled after processing. In other words, work is processed through the plant in batches consisting of a given number of customers' parcels—usually referred to as "bundles." The batch is split up into various "classifications" each of which is washed and finished by a process suited to its use, shape and fabric.

These classifications meet again in the racking room, arriving there on wheeled racks, as shown in the centre of the photograph. The customers' linen books have their identification marks stamped on the back, and after the books are placed in the pigeon-holes round the outside of the circle, the mark hangs over the front of the shelf to make easy the task of the operators responsible for the sorting (racking) by reducing the amount of walking and thus reduce waste of time. In a badly designed "racking room" an operator may walk several miles per day.

After sorting, the racks are rotated around their vertical axes so as to bring the assembled bundles to the outside of the circle, where the operators responsible for the checking and packing of the linen are situated. The racks are double-sided so that the emptied set of shelves is brought to the inside of the circle ready for the assembly of the next batch.

From the above, it will be seen that good lighting is essential in this work, especially to quickly recognise the identification marks.

The racking room at Hounslow Model Laundry.



View of the vestibule from the counter at the Alliance Building Society's offices in Park Lane

Building Society Offices

The new Park-lane offices of the Alliance Building Society are a good example of the growing tendency to consider lighting as an integral part of the interior furnishing and decoration of showrooms, department stores, etc.

The main feature of the design is the circular vestibule formed by a counter on one side, a dwarf partition on the other and a circular lighting trough above. This trough contains four lines of 22-mm. cold cathode tubing, giving indirect lighting from the flat false ceiling above and local direct lighting immediately over the counter through a honeycomb deflector in the underside of the trough. The remaining ambient lighting in the vestibule and surrounding offices is provided by six 8ft. 6in., diameter laylights each containing two coils of 22mm., tubing just inside their perimeters. Flush panels of obscured glass fitted to these laylights give a soft, diffused daylight effect.

The one-story high Park-lane frontage is enlivened by a continuous metal flower trough running along the top of the building. The shrubs in this flower-box are floodlit by a 40 ft. line of amber tubing fitted inside the trough. The firm's name, etched on the inner surface of the plate glass windows and edge-lit from the top, provides an illuminated sign of appropriate restraint.

The offices at the rear of the building are lit by 80-watt., off-white fluorescent tubes in enclosed fittings. The managing director's office, is indirectly lit by two lines of 22-mm., tubing concealed in a continuous metal coving at the cornice.

The vestibule lighting involved approximately 550 ft. of cold-cathode mercury-vapour off-white tubing working from a 7,000-volt H.T. supply with a consumption of about 5,800-watts., and the managing director's office called for approximately 95ft. of similar tubing having a consumption of 1,000-watts.

The architects were Messrs. de Metz and Birks, and the main contractors were Haskins of London, E.C.1. Cold-cathode tubing and H.T. equipment were by Ionlite, Ltd., of Harlesden and the low-tension wiring, etc., was installed by H. J. Galliers, of Brighton.

St. Mary's Cathedral, Newcastle-on-Tyne.

Lighting In a Cathedral

For St. Mary's Cathedral, Newcastle-upon-Tyne, B.T.H. Lighting engineers prepared a scheme of tungsten lighting consisting of 54 Mazda "Harcourt" Mirolux trough reflectors complete with glazing frames, each housing two 100-watt tungsten lamps.

Twenty units are mounted at 24 ft. above floor level over the centre aisle and are positioned in front of the roof beams, where they are concealed from view. There are two side aisles each having fourteen units, again mounted at 24 ft., and the scheme is completed by six fittings in the sanctuary. Four of these have their light concentrated on to the altar.

The electrical contractors for the installation were Messrs. Wilson and Ridley, Ltd., of Newcastle-upon-Tyne, equipment being supplied by the British Thomson-Houston Company, Ltd.

Floodlighting

A prominent landmark for travellers on the main line from London to Edinburgh by day and by night is the new factory built at Newcastle-upon-Tyne by the Imperial Tobacco Company, which has been floodlit by the General Electric Co. Ltd., with sodium, red neon and tungsten lamps.

Careful consideration was given also to the question of colour and an endeavour was made to harmonise with the two-colour daylight appearance. The building is in a combination of red brick and empire stone, the latter being off-white in colour; and it was decided to use red neon floodlighting lamps to illuminate the red brickwork, and sodium lamps to light the empire stonework. Sodium units are interspersed with the red neon lamps along the two main wings, producing a pleasing orange-red effect which is preferable to the deep red of the neon alone, especially when seen at a distance.

The total length of the south elevation is 540 ft. The floodlighting has been carried round each end of the building. The total number of floodlights used is as follows:—

34 Sodium yellow (85 watts.)
24 Neon red (400 watts.)
8 Tungsten with yellow filters (1,000 watts.)

Thus the whole of the floodlighting is achieved for a total electrical load of 21.5 kw.

POSTSCRIPT

By " Lumeritas "

In American lighting literature one often finds expressions of the idea that there must be some greater benefits from illumination levels which are higher than those under which one can get the maximum performance of some chosen " test " visual task. This is true, of course, so far as such higher levels improve visual capacity so that, if necessary, tasks more difficult than the selected " test " one can be done. But if it is found that, for example, the performance of school visual tasks does not improve at levels of illumination higher than N lm/ft^2, will it nevertheless be beneficial to exceed this level of illumination in schoolrooms, and what kinds of benefit will accrue? Are we on the wrong track altogether in recommending different illuminations for different occupations? Should we not rather seek to establish what is the level of illumination above which nothing is to be gained either physiologically or psychologically, so far as we can discover, and then aim always to illuminate interiors to this true optimum value irrespective of the " roughness " or the " fineness " of the visual tasks to be done? This seems to me to be the alternative which those who are dissatisfied with the present bases of recommended illuminations have in mind. It has the merit of simplicity: no more schedules and scales—just one best value! But will it ever be feasible?

Stimulating correspondence is a valuable feature of any journal, and I confess that when my copy of LIGHT AND LIGHTING reaches me each month I now look with some eagerness for the letters to the Editor. One of these, in last month's issue, opens what may well become an interesting and fruitful discussion on the subject of " Quantity and Quality." This is a subject on which I believe some members of the I.E.S. differ rather strongly in their views and, if they rise to Mr. G. P. Wakefield's bait, a lively tussle may ensue; I hope it does—not just because I shall enjoy sitting on the fence and watching the fun, but because I think there is need for clarification of what is meant by the alliterative expression " quantity and quality " as applied to lighting. I suppose no one imagines it is a mere catchphrase but, assuming (rather dubiously perhaps) that lighting can be regarded dichotomously, are " quantity " and " quality " the most appropriate terms under which to divide its constituents?

While on this subject, the remarks on this page in May anent " quality lighting down the river " have brought me an interesting letter from Mr. T. D. Wakefield, of Vermilion, Ohio, enclosing some amusing comments of Mr. J. J. Neidhart, of the Westinghouse Electric Corporation. The latter suggests sending me a glossary of peculiar American expressions, and I should certainly welcome this, especially if it embraces the " funny peculiar "! It appears, however, that I was unwise to say there is probably quality lighting at the penal institution " up the river " for, though Mr. Neidhart disclaims any personal acquaintance with this institution, he thinks it is probably lighted by bare incandescent lamps (and clear ones at that) on drop cords! This reminds me of some visits I paid many years ago (not as a convicted person!) to British penal establishments which certainly had no " quality " lighting. Reverting, however, to the original comment quoted at the beginning of this paragraph, I still don't know what there is " down the river to be ashamed of." The promised glossary will no doubt " put me wise "—or should I say " wise me up "?

A correspondent, referring to a recent news item in the daily Press about the use of searchlights to obtain reflected light from clouds for the purpose of carrying on military training at night, has recalled discussions in which he was engaged in 1941 on the possible use of captive balloons for suspending high-power light sources to illuminate large exterior areas. He suggests that such a method of lighting might be considered in connection with the illumination of the 1951 Exhibition, and he points out that, unlike present methods of floodlighting, such a system of lighting would cast shadows at the correct angles as desired by the architect. I do not know whether any such scheme has been considered by the Exhibition planners, but I have an uneasy feeling that some of the Exhibition buildings, when completed, will be best shadowed altogether.

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